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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: HYDROGENATION CATALYST, PREPARATION THEREOF AND HYDROGENATION PROCESSES USING THIS CATALYST

(57) Abstract: The present invention is directed to a process for hydrogenating one or more organic compounds especially unsaturated organic compounds by bringing the compound into contact with a hydrogen-containing gas in the presence of a catalyst, which comprises one or more catalytically active metals applied to a porous catalyst support. The one or more catalytically active metals having been derived via a decomposed organic complex of the metal on the support, in particular amine complexes of the metal. The decomposed complex may be treated with hydrogen to activate the catalyst before use as a hydrogenation catalyst.



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INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 03/12885

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B01J37/02 B01J37/08 B01J35/10 C07C29/19 C07C67/303
C07C51/36 C07C5/10 C08F8/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B01J C10G C07C C08F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, COMPENDEX, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 761 428 A (SUGIER ANDRÉ AND MIQUEL JEAN) 25 September 1973 (1973-09-25) the whole document	1,2,6,8, 9,11, 13-22, 25,28, 29,39,52
X	US 2 889 287 A (SCOTT JR JOHN W) 2 June 1959 (1959-06-02) the whole document	1,2,6,8, 9,11, 13-21, 23-25, 28,29, 39,52
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

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- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- * & * document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP 03/12885

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-34, 39, 43, 44, 52

Process for hydrogenation of one or more organic compounds
and process for manufacture of a hydrogenation catalyst

2. claims: 35-37

Hydrogenation catalyst

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 03/12885

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>ABOUL-GHEIT AHMED KADRY: "ROLE OF ADDITIVES IN THE IMPREGNATION OF PLATINUM AND RUTHENIUM ON ALUMINA CATALYSTS" JOURNAL OF CHEMICAL TECHNOLOGY AND BIOTECHNOLOGY, vol. 29, no. 8, August 1979 (1979-08), pages 480-486, XP008028876 OXFORD, GB the whole document</p>	<p>1,2,6, 8-22, 30-34,52</p>
X	<p>US 6 284 917 B1 (BREITSCHIEDL BORIS ET AL) 4 September 2001 (2001-09-04) the whole document</p>	<p>1-8,39, 52</p>
X	<p>WO 98/47618 A (EXXON RESEARCH ENGINEERING CO) 29 October 1998 (1998-10-29) the whole document</p>	<p>9,11,13, 14, 23-25, 28,29, 39,52</p>
X	<p>US 5 319 129 A (GUSTAFSON BRUCE L ET AL) 7 June 1994 (1994-06-07) the whole document</p>	<p>1-8, 35-37,52</p>
X	<p>US 4 431 574 A (VASUDEVAN STRINIVASAN ET AL) 14 February 1984 (1984-02-14) tables I,II</p>	<p>35-37</p>
X	<p>US 4 073 750 A (YATES DAVID J C ET AL) 14 February 1978 (1978-02-14) the whole document</p>	<p>35-37</p>

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 03/12885

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3761428	A	25-09-1973	FR 2080099 A5 BE 762396 A1 DE 2107582 A1 GB 1319024 A JP 54009153 B NL 7102303 A US 3856661 A	12-11-1971 02-08-1971 21-10-1971 31-05-1973 21-04-1979 25-08-1971 24-12-1974
US 2889287	A	02-06-1959	US 2880171 A DE 1072595 B DE 1121757 B FR 1209058 A GB 816307 A GB 796175 A GB 823119 A NL 110425 C NL 221942 A	31-03-1959 29-02-1960 08-07-1959 04-06-1958 04-11-1959
US 6284917	B1	04-09-2001	DE 19756913 A1 DE 19832088 A1 AU 759882 B2 AU 2613399 A BR 9813786 A CA 2315223 A1 CN 1285815 T DE 29824628 U1 DE 59808306 D1 WO 9932427 A1 EP 1314714 A2 EP 1042273 A1 ES 2199484 T3 ID 30388 A JP 2001526252 T US 2002019559 A1 ZA 9811614 A	24-06-1999 20-01-2000 01-05-2003 12-07-1999 03-10-2000 01-07-1999 28-02-2001 29-11-2001 12-06-2003 01-07-1999 28-05-2003 11-10-2000 16-02-2004 29-11-2001 18-12-2001 14-02-2002 19-06-2000
WO 9847618	A	29-10-1998	US 5863856 A AU 731432 B2 AU 7136898 A CA 2285062 A1 EP 0977630 A1 JP 2002512556 T NO 995135 A WO 9847618 A1 US 5968991 A US 5945459 A	26-01-1999 29-03-2001 13-11-1998 29-10-1998 09-02-2000 23-04-2002 21-10-1999 29-10-1998 19-10-1999 31-08-1999
US 5319129	A	07-06-1994	CA 2165206 A1 CN 1099382 A , B DE 69410266 D1 DE 69410266 T2 EP 0703895 A1 ES 2118418 T3 JP 8511531 T JP 3499556 B2 SG 46408 A1 WO 9429259 A1	22-12-1994 01-03-1995 18-06-1998 10-09-1998 03-04-1996 16-09-1998 03-12-1996 23-02-2004 20-02-1998 22-12-1994

INTERNATIONAL SEARCH REPORT

International Application No

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Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 4431574	A	14-02-1984	FR	2505205 A1	12-11-1982
			JP	57194044 A	29-11-1982
US 4073750	A	14-02-1978	CA	1087598 A1	14-10-1980
			DE	2719932 A1	01-12-1977
			FR	2351701 A1	16-12-1977
			GB	1578773 A	12-11-1980
			IT	1075845 B	22-04-1985
			JP	52142689 A	28-11-1977
			NL	7705511 A	22-11-1977
			US	4142962 A	06-03-1979